

# **Guidelines for Specifying Structured Plumbing Systems**

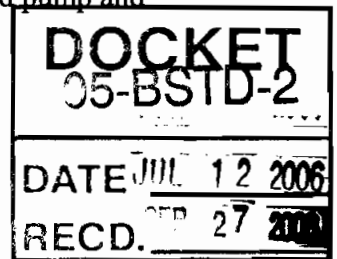
## **PART I - GENERAL**

### **A. Description**

This section includes requirements for materials for the installation Structured Plumbing systems for hot water delivery.

### **B. Submittals**

1. Provide plumbing layout showing location of circulation loop, length of branch lines, diameter of circulation loop and all branch lines, location of on-demand pump and location of all activation mechanisms.
2. Provide materials list showing materials utilized.
3. Provide Certificates of Compliance with all applicable codes.



## **PART 2 – DEMAND CONTROLLED CIRCULATION SYSTEMS**

### **A. Materials**

#### **1. Pump**

- a. The pump shall operate “on-demand”, meaning that it shall receive a signal to turn on from a user shortly prior to the desired hot water draw. The pump shall not operate continuously, on a timer, on an aquastat based temperature controller or by a combination of timer and aquastat. Show the location of the pump on the plumbing layout.
- b. The pump must have the capacity to overcome the pressure drop in the circulation loop and still move the water relatively quickly. The smaller the diameter, the longer the length and the more additional restrictions to flow (such as 90 degree turns through elbows and tees), the greater the pressure drop. In general, the greater the pressure drop in the circulation loop, the bigger the pump.
- c. Follow the sizing guidelines recommended by the manufacturers of Demand Controlled Recirculation Systems.

#### **2. Controls and Activation Mechanisms**

- a. The controls shall be electronic and operate on the principal of shutting off the pump with a rise in temperature (Delta-T). If the thermo-sensor that measures temperature rise fails to operate, the electronic controls must have a lock out to prevent operation above 105°F degrees. The electronic controls shall also have a fail safe timer to prevent extended operation of the pump if the sensor fails or is damaged.
- b. Refer to the manufacturers of Demand Controlled Recirculation Systems to select appropriate activation mechanisms for the specific application.
- c. Hard Wired Activation Mechanisms
  - i. Button. Buttons shall be normally-open, momentary close switches.

- ii. Motion Sensor. Motion sensors shall make a momentary contact when motion is sensed. After the signal is sent, the sensor shall go into a lock out mode for a short period of time to prevent sending a signal to the electronic controls while the circulation loop is still hot.
    - iii. Other including flow switch or door switch
  - d. Wireless Activation Mechanisms
    - i. Button. Same as above.
    - ii. Motion Sensor. Same as above.
- 3. Demand Controlled Recirculation Systems include the pump, electronic controls and activation mechanisms. These systems must be certified to meet nationally accepted plumbing and electrical standards (for example, IAPMO/UPC and UL/ULC). Acceptable manufacturers of these systems shall be ACT Inc., Metlund Systems, Taco, or Wirsbo or equivalent.

## **B. Execution**

- 1. Pump
  - a. Install pump(s), controls and activation mechanisms in accordance with applicable codes and manufacturer's instructions.
  - b. Pump(s) shall be installed to facilitate repair and replacement
- 2. Activation Mechanisms
  - a. In general, provide one activation mechanism for each hot water location. Provide an explanation if less than one activation mechanism per location is needed. Show location of all activation mechanisms on the plumbing layout.
  - b. Hard Wired Activation Mechanisms
    - i. Button located on a switch plate in a convenient location.
    - ii. Motion Sensor located to trigger when someone gets near the hot water location.
  - c. Wireless Activation Mechanisms
    - i. Button. Give these to the homeowner so that they can put them where convenient. Possible locations include near the kitchen sink, at the head of the bed in the master bedroom, in the laundry room, on the mirror in the guest bathroom.
    - ii. Motion Sensor located to trigger when someone gets near the hot water location.
  - d. Other including flow switch or door switch
    - i. Refer to manufacturers of Demand Controlled Recirculation Systems to select one of these activation mechanisms.
- 3. Circulation Loop
  - a. System shall have a line that returns water to the hot water heater. Either a dedicated return line shall be installed, or the cold water line may be used as a temporary return.

- A dedicated return line shall be installed if motion sensors are used to activate the pump. Show the location of the circulation loop on the plumbing layout.
- b. A check valve shall be installed in the circulation loop to prevent unintentional circulation of the water (thermo-syphoning) and back flow when the system is not operating. This check valve may be included with the pump.
  - c. The supply portion of the circulation loop shall be sized in accordance with applicable plumbing codes. The circulation loop shall have a minimum diameter of  $\frac{3}{4}$  inch nominal anywhere in the loop including the return from the last fixture to the water heater. This applies to both dedicated and cold-water line returns.
  - d. Locate all fixtures no more than 10 plumbing feet from the circulation loop. The distance includes all fittings and shall be measured from the loop to the place where the pipe serving each fixture comes through the wall or floor, or connects to the valve (such as for showers and tubs, which are generally hidden).
  - e. Keep the restrictions to flow in the circulation loop to a minimum by minimizing the number of fittings.
    - i. Copper and CPVC
      1. Elbows – minimize to the extent practical the number of hard 90 degree elbows since these have a major impact on the equivalent feet and increase the resistance that the pump must overcome. Use manufactured wide sweeping elbows or bendable copper. Preferred radius is 8-12 times pipe diameter.
      2. Couplings – minimize the number.
      3. Tees – required for branch lines. Where applicable, mini-manifolds with multiple tees may be used.
    - ii. Cross-linked Polyethylene (PEX)
      1. Elbows – minimize the number to the extent practical of hard 90 degree elbows since these have a major impact on the equivalent feet and increase the resistance that the pump must overcome. Use the tubing's flexibility to make the bends. Follow manufacturer's instructions for minimum radius on all bends.
      2. Couplings – minimize their use since they also increase the equivalent feet and resistance. In general, make the joints at the tees for the branches.
      3. Tees – required for branch lines. Where applicable, mini-manifolds with multiple tees may be used.
4. Branch Lines
- a. Branch lines shall be the shortest possible length from the recirculation line to the fixture with a maximum distance of 10 feet. Exceptions may be requested for island sinks, tubs (not tub-shower combos) and washing machines, and must be approved by the builder.
  - b. Select the diameter of the branch lines in accordance with the UPC, in general  $\frac{1}{2}$  or less. Exceptions must be approved by the builder.
  - c. Each fixture should be served with its own branch line. Example exceptions include: a branch line serving two sinks so that the total distance from the water heater to each sink is less than 10 plumbing feet, or a water heater serving a sink and a shower or tub/shower combo. Exceptions must be approved by the builder.

- d. Minimize the number of fittings in the branch lines to the extent practical, particularly hard elbows.

5. Insulation

- a. All hot water lines shall be insulated from the water heater to as near as practical to every fixture. This includes the supply portion of the circulation loop, the dedicated return line and all branch lines.
- b. Minimum R-4 pipe insulation shall be used. An exception may be requested for the branch lines.
- c. Install in accordance with the pipe insulation manufacturer's specifications. Pay particular attention to details at elbows and tees and all joints.

6. Commissioning the system

- a. Purge all pipes before installing the pump to remove air and other unwanted materials.
- b. Get the water heater(s) up to the desired temperature in accordance with the water heater manufacturer's instructions.
- c. Follow the manufacturer's instructions applicable to each pump, controls and activation mechanisms to ensure that the system is operating correctly.
- d. Preheat the circulation line to check for proper operation.
- e. Measure how much water comes out of each fixture before hot water arrives. It should be less than two cups at all fixtures except those for which an exception has been approved.

7. Customer Education

- a. Provide the homeowner with all warranty and operational material supplied by the manufacturer. Instructions need to explain how to prime or preheat the circulation loop. This information should advise the customer how and when the system should be turned off to prevent damage and what to do in the event of a water or electricity outage.

**C. Warranties**

- 1. All hot water circulation systems shall have a minimum of a two year warranty from the date of manufacture.